The Chronometric Gap from Early Jomon in Southern Hokkaido: A Radiocarbon and Thermoluminescence View

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In 1966 and 1969, Naotsune Watanabe published two articles indicating a radiocarbon (C-14) chronological gap in the published series relating to the estimated Early Jōmon sequence of approximately 6050 to 3200 B.C. Explanations offered for this 2800-year gap were tied to inconsistencies seen in the Initial Jōmon period. During this earlier period the dates for Hokkaido were regarded as markedly dispersed within a wide time range and " . . . those of Honshu are inconsistent with the Chronological order of pottery types. Moreover, in the latter [Honshu] there is a gap of 2500 years which is too long . . . as there were eight pottery types having no available radiocarbon date as yet" (1966: 157). A second explanation for the discrepancies noted was tied to inferred climatic changes which may have affected the reported dates.

The focus of this paper will not be on the Early Jōmon chronological gap in Honshu, as this hiatus has been partially filled by dates from the Uchinoyama site and Ta shell mound in Ibaragi Prefecture which have yielded respectively two dates each. The dates are reported here using the MASCA correction factor (Ralph, Michael, and Han 1974):

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5340 ± 140 C-14 yrs. (N200–1) 3390 B.C. or 4370 B.C. (MASCA)
5340 ± 140 C-14 yrs. (N200–2) 3390 B.C. or 4370 B.C. (MASCA)
5630 ± 140 C-14 yrs. (N191–2) 3680 B.C. or 4490 B.C. (MASCA)
5640 ± 140 C-14 yrs. (N191–1) 3690 B.C. or 4500 B.C. (MASCA)

The Sanrizuka no. 14 site in Chiba Prefecture yielded three dates, reported here also using the MASCA correction factor to its present published limits of 4760 B.C. corrected to 5350 B.C.

6740 ± 150 C-14 yrs. (N368) 4790 B.C. or 5350 B.C.
7080 ± 150 C-14 yrs. (N514) 5130 B.C. or 5350 B.C.
7200 ± 110 C-14 yrs. (Gak-175) 5250 B.C. or 5466 B.C.

These recent dates have been reported by Masao Suzuki (1973 and 1974), and they appear to fill the chronological gap referred to by N. Watanabe (1966, 1969). Suzuki lists a series of Initial to Final Jōmon dates (1973: Table 10 and Fig. 27), and using the MASCA corrections, he lists (p. 311) the following ranges:

Initial Jōmon	6750– B.P.	4800 B.C.
Early Jōmon	6750–5450 B.P.	4800 B.C.–3500 B.C.
Middle Jōmon	5450–4300 B.P.	3500 B.C.–2350 B.C.
Late Jōmon	4300–3250 B.P.	2300 B.C.–1300 B.C.
Final Jōmon	3250–2800 B.P.	1300 B.C.– 850 B.C.

He does add, however, that "the application of these correction factors to radiocarbon dates in Japan is perhaps premature because the local variation of the radiocarbon concentration in the atmosphere is not elucidated yet" (1973: 312).

Prior to our work on the Hokkaido Hamanasuno data (Hurley 1974), the temporal dispersion for the Initial and Early Jōmon in Hokkaido noted by Watanabe appeared to hold true. Initial Jōmon with its corrected dates extends from 5981 B.C. to 4000 B.C. using midpoints for the corrected dates. Early Jōmon appears to extend from 5390 B.C. to 1710 B.C. (Table 1). Thus Initial Jōmon is reported here to have a temporal spread of 1981 C-14 years and Early Jōmon to have a C-14 longevity of 3680 years. Both periods would overlap by a medium figure of 1390 years.

The six C-14 dates for the Initial Jōmon sites and the sixteen C-14 dates for the Early Jōmon Hokkaido sites appear to represent the total C-14 dates reported as of 1976. However, when Watanabe reported his list in 1966 many of these dates were not included, so the situation of chronological dispersion has been altered. In 1968, while examining cord decorations on Jōmon vessels from the Kanto, Tohoku, and Hokkaido areas (Hurley 1970 and 1978*b*), Hurley discussed the Hokkaido chronological situation with Masakazu Yoshizaki, then Curator of Archaeology at the Hakodate City Museum. The museum contained collections from several important sites, and Yoshizaki offered small sherd samples for thermoluminescence (TL) dating in the hope that another independent chronological sequence could be established. Other research and the absence of facilities in Toronto placed this line of inquiry in limbo until 1974.

TABLE 1. HOKKAIDO C-14 DATES

B.P.	LAB	B.C./A.D.	CORRECTED B.P.	CORRECTED B.C./A.D.	SITE	REFERENCE
			Initial Jōmon (Earliest Jōmon)			
7700 ± 200	I551	5750 B.C. ± 200	7930	MASCA 5981 B.C. ± 210	Kojohama	Oba and Chard 1963
7680 ± 200	I550	5730 B.C. ± 200	7910	MASCA 5960 B.C. ± 210	Kojohama	Oba and Chard 1963
7100 ± 115	WIS178	5150 B.C. ± 115	7313	MASCA 5363 B.C. ± 125	Yubetsu	Oba 1970
6795 ± 150	GX281	4845 B.C. ± 150	7000	MASCA 5050 B.C. ± 160	Omagari	Oba 1970
5260 ± 100	Gak 642	3310 B.C. ± 100	5420	MASCA 4160–4090 B.C. ± 110	Omagari	Oba 1970
5190 ± 80	WIS175	3240 B.C. ± 80	5345	MASCA 4000 B.C. ± 90	Kojohama	Bender 1967
			Early Jōmon			
7130 ± 120	Gak 1581	5180 B.C. ± 110	7340	MASCA 5390 B.C. ± 120	Kushiro	Oba 1970
6800 ± 225	I553	4850 B.C. ± 225	7000	MASCA 5050 B.C. ± 235	Misato	Oba 1970
5640 ± 200	?	3690 B.C. ± 200	5809	MASCA 4500 B.C. ± 210	Uenae	Ogasawara et al. 1976, Sato 1976*a*
5680 ± 380	P2471	3730 B.C. ± 380	5860	MASCA 4450 B.C. ± 390	Hamanasuno	
5440 ± 105	Gak 5492	3490 B.C. ± 105	5603	MASCA 4370 B.C. ± 115	Morikoshi	Mineyama 1975
5420 ± 330	P2470	3490 B.C. ± 330	5590	MASCA 4360 B.C. ± 340	Hamanasuno	
4960 ± 350	P2460	3101 B.C. ± 350	5110	MASCA 3750 B.C. ± 360	Hamanasuno	
4970 ± 90	Gak 5488	3020 B.C. ± 90	5120	MASCA 3750 B.C. ± 100	Morikoshi	Mineyama 1975
4950 ± 310	P2472	3000 B.C. ± 310	5090	MASCA 3740 B.C. ± 320	Hamanasuno	
4650 ± 330	P2461	2700 B.C. ± 330	4790	MASCA 3400–3470 B.C. ± 340	Hamanasuno	
4550 ± 105	Gak 5491	2600 B.C. ± 105	4686	MASCA 3370–3350 B.C. ± 115	Morikoshi	Mineyama 1975
4540 ± 110	Gak 5490	2590 B.C. ± 110	4676	MASCA 3350 B.C. ± 120	Morikoshi	Mineyama 1975
4660 ± 130	P2459	2710 B.C. ± 130	4550	MASCA 3350–3270 B.C. ± 140	Hamanasuno	
4500 ± 140	Gak 485	2550 B.C. ± 140	4630	MASCA 3330–3220 B.C. ± 150	Bibi	Matsushita 1967
4400 ± 95	Gak 5489	2450 B.C. ± 95	4532	MASCA 3160 B.C. ± 105	Morikoshi	Mineyama 1975
3800 ± 140	Gak 484	1850 B.C. ± 140	3910	MASCA 2290–2190 B.C. ± 150	Bibi	Matsushita 1967

5350 ± 110	Gak 5497	3400 B.C. ± 110	5510	30–4270 B.C. ± 120	Morikoshi	Mineyama 1975
5230 ± 170	Gak 5494	3280 B.C. ± 170	5386	MASCA 4060–4040 B.C. ± 180	Morikoshi	Mineyama 1975
5230 ± 105	Gak 5499	3280 B.C. ± 105	5387	MASCA 4060–4040 B.C. ± 115	Morikoshi	Mineyama 1975
5070 ± 350	Gak 4423	3120 B.C. ± 350	5221	MASCA 3880–3850 B.C. ± 360	Nishikikyo	Chio 1974
5060 ± 115	Gak 5495	3110 B.C. ± 115	5211	MASCA 3850–3820 B.C. ± 125	Morikoshi	Mineyama 1975
4960 ± 105	Gak 5498	3010 B.C. ± 105	5108	MASCA 3740 B.C. ± 115	Morikoshi	Mineyama 1975
4820 ± 100	Gak 5496	2870 B.C. ± 100	4965	MASCA 3720 B.C. ± 110	Morikoshi	Mineyama 1975
4790 ± 100	Gak 4687	2840 B.C. ± 100	4934	MASCA 3620 B.C. ± 110	Nishimata	Matsushita 1974
4740 ± 340	Gak 4691	2790 B.C. ± 340	4882	MASCA 3570–3600 B.C. ± 350	Nishimata	Matsushita 1974
4660 ± 100	Gak 5593	2710 B.C. ± 100	4799	MASCA 3470–3400 B.C. ± 110	Morikoshi	Mineyama 1975
4530 ± 350	Gak 4422	2580 B.C. ± 350	4665	MASCA 3350–3270 B.C. ± 360	Nishikikyo	Chio 1974
4360 ± 240	Gak 4427	2410 B.C. ± 240	4490	MASCA 3150 B.C. ± 250	Nishikikyo	Chio 1974
4350 ± 210	Gak 4692	2400 B.C. ± 210	4480	MASCA 3150 B.C. ± 220	Nishimata	Matsushita 1974
4320 ± 110	Gak 4430	2370 B.C. ± 110	4449	MASCA 3110–3010 B.C. ± 120	Nishikikyo	Chio 1974
4230 ± 110	Gak 4426	2280 B.C. ± 110	4356	MASCA 2960–2930 B.C. ± 120	Nishikikyo	Chio 1974
4220 ± 100	Gak 4696	2270 B.C. ± 100	4347	MASCA 2960–2930 B.C. ± 110	Nishimata	Matsushita 1974
4180 ± 115	Gak 4436	2230 B.C. ± 115	4305	MASCA 2920 B.C. ± 125	Nishikikyo	Chio 1974
4150 ± 400	Gak 118	2200 B.C. ± 400	4270	MASCA 2900–2880 B.C. ± 410	Tokoro	Komai 1963
4120 ± 110	Gak 4439	2170 B.C. ± 110	4273	MASCA 2850 B.C. ± 120	Nishikikyo	Chio 1974
3990 ± 125	N1114	2040 B.C. ± 125	4110	MASCA 2600 B.C. ± 135	Hamabekkai	Yawata 1966, 1971
3990 ± 105	Gak 4438	2040 B.C. ± 105	4109	MASCA 2600 B.C. ± 115	Nishikikyo	Chio 1974
3960 ± 115	Gak 4693	2010 B.C. ± 115	4079	MASCA 2570 B.C. ± 125	Nishimata	Matsushita 1974
3960 ± 130	Gak 4690	2010 B.C. ± 130	4079	MASCA 2570 B.C. ± 140	Nishimata	Matsushita 1974
3950 ± 200	W372	2000 B.C. ± 200	4070	MASCA 2560 B.C. ± 210	Taniguchi	Oba 1970
3950 ± 110	Gak 4425	2000 B.C. ± 110	4068	MASCA 2560 B.C. ± 120	Nishikikyo	Chio 1974
3930 ± 90	Gak 4689	1980 B.C. ± 90	4048	MASCA 2550 B.C. ± 100	Nishimata	Matsushita 1974

TABLE 1—*Continued*

B.P.	LAB	B.C./A.D.	CORRECTED B.P.	CORRECTED B.C./A.D.	SITE	REFERENCE
			Middle Jōmon—Continued			
3920 ± 105	Gak 4437	1970 B.C. ± 105	4037	MASCA 2540–2490 B.C. ± 115	Nishikikyo	Chio 1974
3900 ± 120	N226	1950 B.C. ± 120	4020	MASCA 2540–2490 B.C. ± 130	Tosamporo	Yawata 1966, Yamazaki 1967
3900 ± 100	Gak 4431	1950 B.C. ± 100	4017	MASCA 2480 B.C. ± 110	Nishikikyo	Chio 1974
3880 ± 110	Gak 4688	1930 B.C. ± 110	3996	MASCA 2480–2440 B.C. ± 120	Nishimata	Matsushita 1974
3850 ± 260	Gak 5031	1900 B.C. ± 260	3965	MASCA 2410–2340 B.C. ± 270	N 293	Ueno 1974
3825 ± 75	I552	1875 B.C. ± 75	3940	MASCA 2330–2210 B.C. ± 85	Nakazawa	Oba 1962
3750 ± 110	Gak 4424	1800 B.C. ± 110	3862	MASCA 2180 B.C. ± 120	Nishikikyo	Chio 1974
3730 ± 100	Gak 4432	1780 B.C. ± 100	3841	MASCA 2170 B.C. ± 110	Nishikikyo	Chio 1974
3690 ± 115	Gak 4433	1740 B.C. ± 115	3800	MASCA 2160 B.C. ± 125	Nishikikyo	Chio 1974
3650 ± 110	Gak 4435	1700 B.C. ± 110	3759	MASCA 2140 B.C. ± 120	Nishikikyo	Chio 1974
3230 ± 160	I?	1290 B.C. ± 160	3340	MASCA 1630–1600 B.C. ± 170	Tosamporo	N. Watanabe 1966
1910 ± 90	Gak 4434	A.D. 70 ± 90	1967	MASCA A.D. 70 ± 100	Nishikikyo	Chio 1974
			Late Jōmon			
3270 ± 110	Gak 3245	1320 B.C. ± 110	3368	MASCA 1640–1600 B.C. ± 120	Hiyoshi	Chio 1971
3230 ± 160	W322	1280 B.C. ± 160	3330	MASCA 1600–1570 B.C. ± 170	Uenae	N. Watanabe 1966
			**Final Jōmon*			
2650 ± 120	Gak 4705	700 B.C. ± 120	2729	MASCA 850–880 B.C. ± 130	Satsukari	Nomura 1974

3290 ± 210	Gak 4419	1340 B.C. ± 210	3388	MASCA 1650 B.C. ± 220	Nishikikyo	Chio 1974
2560 ± 190	Gak 4428	610 B.C. ± 190	2739	MASCA 880–850 B.C. ± 200	Nishikikyo	Chio 1974
2650 ± 120	Gak 4705	700 B.C. ± 120	2730	MASCA 880–850 B.C. ± 130	Satsukari	Nomura 1974
2380 ± 120	Gak	430 B.C. ± 120	2451	MASCA 490 B.C. ± 130	Itankihama	Shimoda 1966
2370 ± 120	Gak	420 B.C. ± 120	2441	MASCA 470 B.C. ± 130	Itankihama	Shimoda 1966
2220 ± 100	Gak 4429	270 B.C. ± 100	2286	MASCA 400 B.C. ± 110	Nishikikyo	Chio 1974
2040 ± 120	Gak	90 B.C. ± 120	2101	MASCA 110–70 B.C. ± 130	Esan B. Loc	Mineyama 1968*a*
2020 ± 145	Gak 4419	70 B.C. ± 145	2080	MASCA 100–10 B.C. ± 155	Nishikikyo	Chio 1974
2010 ± 120	Gak	60 B.C. ± 120	2070	MASCA 60 B.C.–A.D. 10 ± 130	Itankihama	Shimoda 1966
1990 ± 80	Gak	40 B.C. ± 80	2049	MASCA A.D. 10 ± 90	Rebunge	Mineyama 1968*b*
1950 ± 120	N147	0 A.D. ± 120	2010	MASCA 60 B.C. ± 130	Fugoppe	Natori 1966
1920 ± 120	N50–2	30 A.D. ± 120	1980	MASCA 30 B.C. ± 130	Fugoppe	Natori 1966
1880 ± 80	Gak	70 A.D. ± 80	1936	MASCA A.D. 70 ± 90	Esan A. Loc	Mineyama 1968*a*
1870 ± 100	N146	80 A.D. ± 100	1930	MASCA A.D. 20 ± 110	Fugoppe	Natori 1966
375 ± 90	I554	1575 A.D. ± 90	390	MASCA A.D. 1560 ± 100	Koboro	Oba 1963

* Dates not included in Figure 8.

During the summer of 1974 Yoshizaki and the senior author directed excavations at the Hamanasuno site in the town of Minamikayabe, Hokkaido (Fig. 1). On the basis of our excavations during the field season we concluded that the area explored was essentially a single component Early Jōmon occupation (Hurley 1974). Previous excavations in 1973 (Fig. 2) and those conducted during 1975 have produced no conflicting evidence of a stronger Middle Jōmon component greater than the few sherds we noted.

The fieldwork in Japan in 1974 grew out of observations centered around

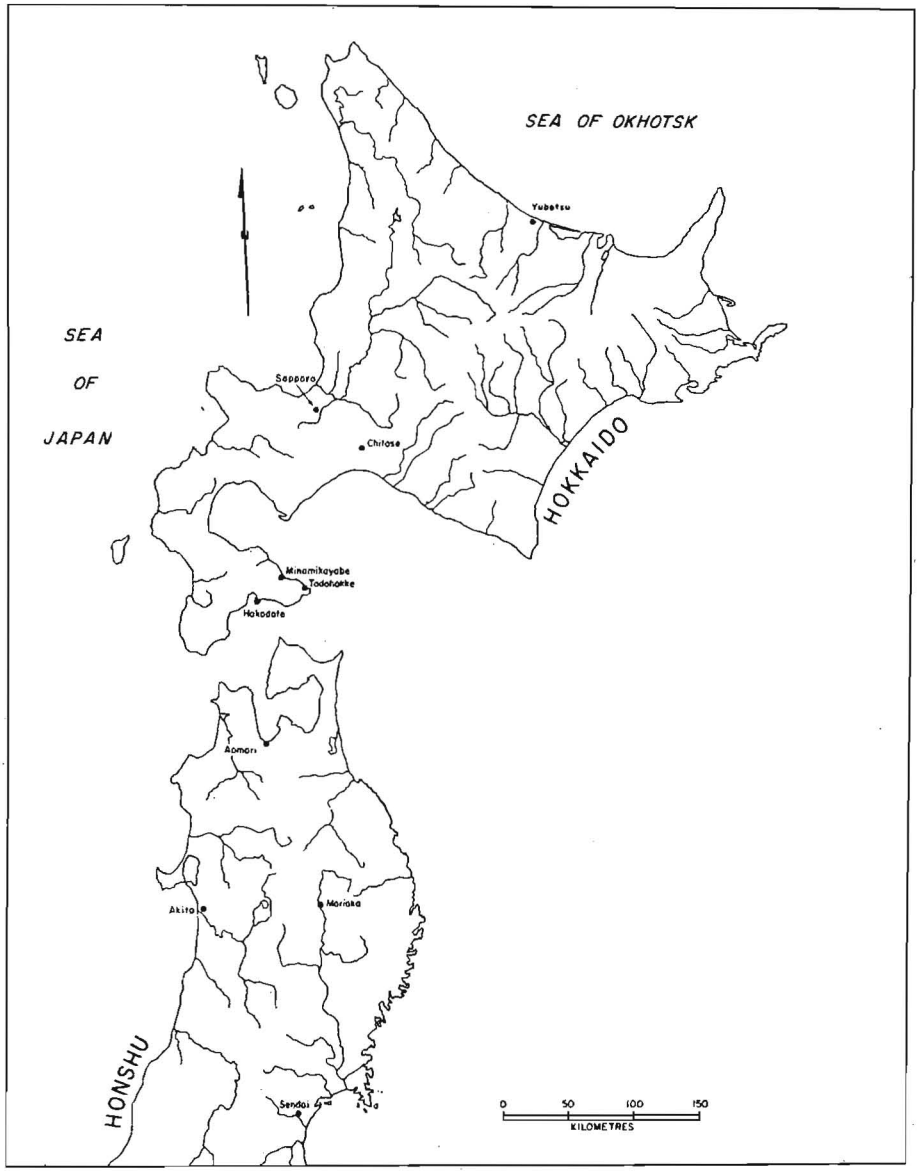


Fig. 1 Location of Minamikayabe and major towns and cities in Hokkaido and northern Honshu.

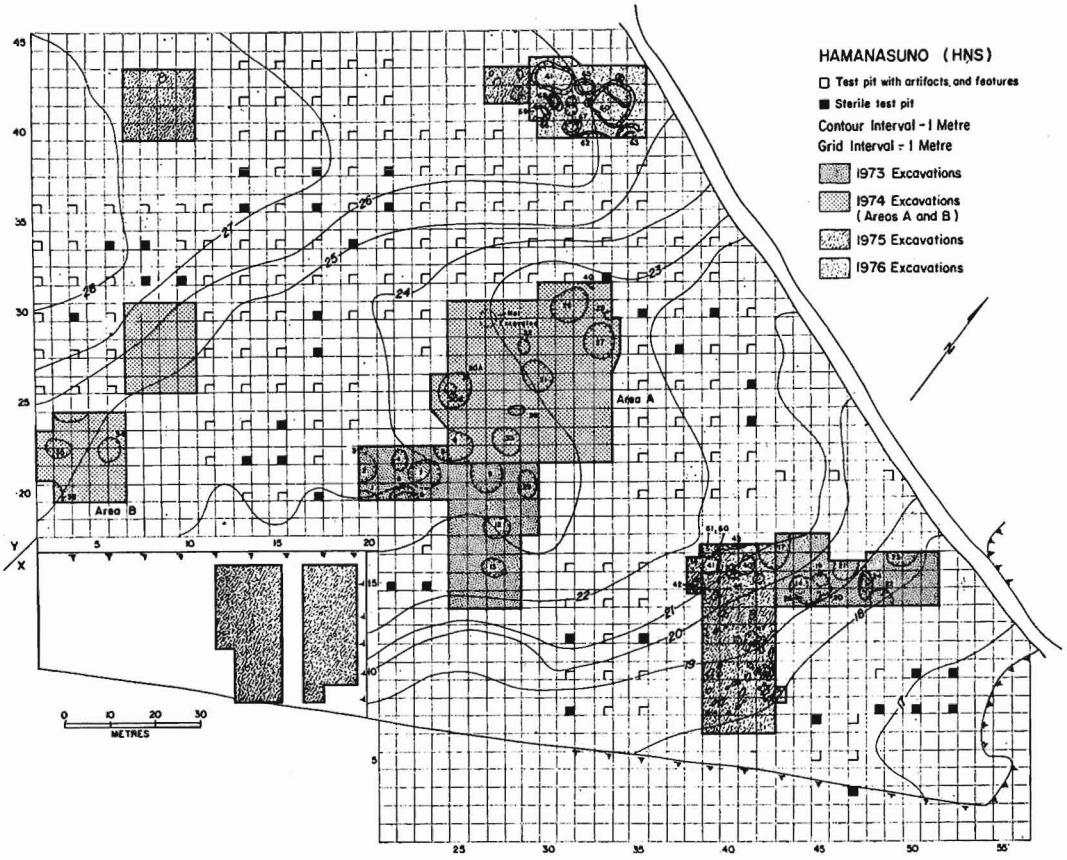


Fig. 2

Hokkaido Jōmon that were noted in 1968: (A) The apparent marked absence of detailed quantification and qualification of cords as applied to Jōmon ceramics, and the consequent need for determining (1) chronological cord and fabric sequences as derived from ceramics, (2) the types of cords applied to various vessel locations and the stylistic shifts from vessel groups *(shiki)* or types, and (3) the presentation of this data according to vertical and/or horizontal tabular form for easy micro-decorative comparison between Jōmon sites; and (B) the view held by archaeologists that Hokkaido lacked domesticated plants until the 1860s, due primarily to its position within a severe climate zone (Hayashi 1967; Kidder 1959; Morlan 1966). The absence of prehistoric agricultural practices in Hokkaido also indicated that the climate was unsuitable for rice paddy cultivation; thus the climatic regimen plus historical factors were responsible for Hokkaido being the last holdout of aboriginal culture in the Japanese archipelago (Morlan 1966: 1). Hurley (1974) has questioned these climatic interpretations by archaeologists, as such interpretations could be at variance with paleoclimatic evidence derived from site contexts.

Finally, of related concern at that time were two articles published by Naotsune Watanabe (1966 and 1969) indicating a C-14 chronological gap in the published

Jōmon series from ca. 6050 B.C. to about 3200 B.C. This gap was not explained, and it appeared that the particular Jōmon period in which we were interested was without firm chronological control except for the two dates (5750 B.C. and 4845 B.C.) reported by Kidder (1969: Appendix. Jōmon Chronology). It seemed then that if there were factors affecting the preservation of charcoal, thermoluminescence ceramic dates might tend to narrow this gap.

Thus, there were related problems concerning Early Jōmon research in southwestern Hokkaido in the senior author's mind in 1968: (1) a lack of precision in cord analyses from Jōmon sites; (2) a lack of documented paleoenvironmental evidence concerning the subsistence base; and (3) an unexplained Early Jōmon C-14 chronological gap. The only hope of partially resolving these problems centered upon productively excavating an undisturbed Early Jōmon site in southwestern Hokkaido which was at a low altitude and close to the sea coast to take advantage of microclimatic ameliorating effects brought about by its physiographic position. With the help of Yoshizaki, Hurley decided the Hamanasuno site could provide the proper setting to resolve some of these problems. Assisted by Theresa Ferguson, who helped with computer coding of recovered data, Gary Crawford, our paleoethnobotanist in charge of on-site flotation, and a Japanese crew, Hurley excavated a total 1300 m^2 of Hamanasuno in 1974. Eight houses, 5400 partial to complete vessels, and thousands of chipped and ground stone artifacts were recovered in good village context, suggesting that we were dealing with a lengthy occupation by peoples who must have been dependent on gathered land foods, sea and river resources, and cultivated plants. Our immediate working hypothesis after the field season was as follows:

Early Jōmon peoples at the Hamanasuno site had houses found in clusters suggesting definite settlement patterns. The amount of artifacts recovered and the size of the houses suggested a lengthy occupation rather than activities of nomadic hunters and gatherers. The then-apparent absence of plant and animal remains, wooden bows, fishhooks, harpoon heads, and dugout canoes provided negative evidence for their economic life. However, the presence of metates and manos plus thousands of vessels possibly used for food storage suggested that these people were extensively dependent on very local "wild" resources in addition to some buckwheat (Crawford, Hurley, and Yoshizaki, this volume). Others have argued that Jōmon peoples cultivated plants (Esaka 1967, Fujimori 1970, Ishida and Izumi 1968: 15–73, and Kimura 1963) on the basis of such food-preparation items and storage containers. Kotani (1972) has shown through analyses of paleoethnobotanical data that the "pre-adapted" incipient agricultural base proposed by Hitoshi Watanabe (1966) is valid for the Final Jōmon period. We proposed that the economic base for Jōmon in southwestern Hokkaido has been a hypothesis based on a series of alternatives which have not been derived from site environmental studies. The Hamanasuno site was thought to provide an investigative base from which explanations could be offered for their apparent subsistence success, increase in population, and social organization possibly shifting from band to tribal level.

The exploitative nature of the Hamanasuno peoples is elaborated upon in the paper by Crawford, Hurley, and Yoshizaki published in this volume. Our intention in this paper is to place the Hamanasuno dates into the presently known chronological framework for southern Hokkaido. The Minamikayabe Board of Education through

the efforts of Yoshizaki granted us permission to remove ceramic samples to Toronto as a donation to the Royal Ontario Museum for the purpose of obtaining thermoluminescence dates. In January 1975, Hurley was contacted by Elizabeth K. Ralph who wondered if we had a series of sherds that could be related to Watanabe's ceramic types while also spanning the reported chronological gap. The relatability of our ceramics to those from central Honshu will have to await the completion of our analyses. However, as we will emphasize here, the Hamanasuno material does appear to represent a part of the Early Jōmon sequence in Hokkaido (the Ento-Kaso series).

In order to place the Hamanasuno data into a southern Hokkaido chronological sequence, Hurley requested that Ralph also date, by thermoluminescence, samples donated in 1968 and believed to span the Jōmon sequence. Sherds from Sumiyoshi, Saibezawa, Shoppu, Hiyoshi, and Kawakami (Fig. 3) were used, but it must be emphasized that none of the specimens had information other than general site context and only two had either vertical or horizontal provenience. Identification of these specimens to their ascribed types will ultimately be of further aid in interpreting the dating results.

Fig. 3 Location of Hokkaido sites mentioned in the text.

It is not our intention to present a detailed discussion of thermoluminescence dating technique, as several excellent short papers are available (Yoneta Ichikawa 1965 and 1967; Aitken et al. 1967; Aitken 1970; and Winter 1971).

Thermoluminescence dating "sets out to measure the time elapsed since a piece of pottery was last heated to more than about 500°C—normally the time elapsed since firing" (Winter 1971: 118). As Aitken explains (1970: 82), "heating to above 500°C removes the accumulated thermoluminescence and consequently the firing of clay into pottery sets the 'thermoluminescent clock' to zero. Thereafter the thermoluminescence grows with time . . ." and this growth can be measured.

While the 1968 sample and the 1974 material were undergoing thermoluminescence dating at the Museum Applied Science Center for Archaeology, Hurley sought out the published radiocarbon dates and obsidian hydration dates for Hokkaido. Following what Neustupny (1970) refers to as "the second revolution" in radiocarbon dating, we have followed the MASCA corrections and calibrations to correct the B.P. (Before Present) and B.C./A.D. results to the current maximum corrected midpoint of 5350 B.C. (Ralph, Michael, and Han 1974). The results are presented below and in Table 1 according to schemes suggested by Rippeteau (1974) and Brennan (1974). Following Suzuki and using the MASCA corrections the present ranges for Hokkaido C-14 dates are:

Initial Jōmon	7930 B.P. to 5345 B.P.	>5981 B.C. to 4000 B.C.
Early Jōmon	7340 B.P. to 3471 B.P.	>5390 B.C. to 1710 B.C.
Middle Jōmon	5510 B.P. to 3340 B.P.	4330 B.C. to 1630 B.C.
Late Jōmon	3368 B.P. to 3330 B.P.	1640 B.C. to 1570 B.C.
Final Jōmon	2730 B.P. to —	880–850 B.C. to —
Epi Jōmon	3388 B.P. to 390 B.P.	1650 B.C. to 1560 A.D.

For the purposes of this report only those dates for Initial through Middle Jōmon need concern us. Table 1 illustrates that for Initial Jōmon there is a possible 1981 C-14 year spread represented by three sites or village locations. The date for the unknown site does not appear to be beyond the normally accepted range for Initial Jōmon in Hokkaido and for the range reported by Suzuki. The dates listed for Early Jōmon from the sites suggest the expected temporal overlap with Initial Jōmon and that Early Jōmon had a plausible life-span. However, the first three Initial Jōmon dates and the first two Early Jōmon dates exceed the range reported by Suzuki, suggesting that there may not have been a gradual south to north temporal slope for Jōmon Japan at these periods/stages. The Middle Jōmon range for Hokkaido appears to exceed the Honshu Middle Jōmon range and, while the beginning of the Late Jōmon appears to represent some temporal or cultural lag, the one Final Jōmon date corresponds with the terminal portion of this period as reported by Suzuki.

Obviously many more dates are needed from these and other sites to illustrate clearly the flow and directions of Jōmon peoples both in Hokkaido and from central to northern Honshu. We will now turn to our thermoluminescence (TL) dates (Table 2) for the samples listed. Ralph and Han felt that in general the material was not very well fired, leaving open the possibility that some of the geologically accumulated TL was not driven off when the pottery was made. Thus, in some cases the dates obtained seem to be earlier than predicted.

In the case of PT 414A, from the Hakodate City Sumiyoshi site, the unreasonably early date seems to be a function of a very low TL signal produced after irradiation. We know ceramics are early in Japan, but this date of 18,720 B.C. is several thou-

TABLE 2. THERMOLUMINESCENCE/OBSIDIAN HYDRATION DATES

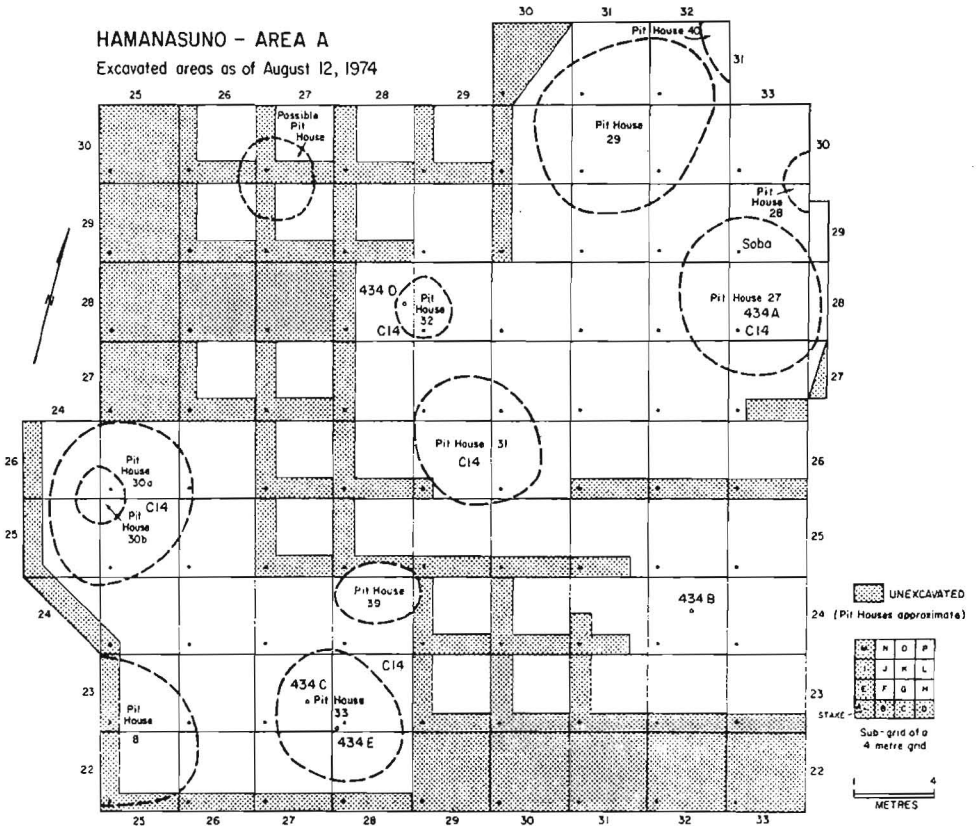
DATE	LAB AND NO.	ALPHA C/HR	SITE	REFERENCE
		Initial Jōmon (Earliest Jōmon)		
*18,720 B.C. ± 1500	MASCA PT 414A	11.53 ± 0.17	Sumiyoshicho	Oba and Kodama 1953
7000 B.C. ± 500	MASCA PT 415A	7.66 ± 0.24	Saibezawa	Oba 1958
5850 B.C.	Obsidian 1		Shinyoshino	Kondo and Katsui 1965
		Early Jōmon		
5900 B.C. ± 1000	MASCA PT 434A	7.55 ± 0.20	Hamanasuno	Hurley
4360 B.C. ± 440	MASCA PT 414B	12.81 ± 0.20	Sumiyoshicho	Oba and Kodama 1953
4200 B.C. ± 600	MASCA PT 434C	10.65 ± 0.24	Hamanasuno	Hurley
4050 B.C. ± 550	MASCA PT 434D	9.53 ± 0.25	Hamanasuno	Hurley
4000 B.C. ± 600	MASCA PT 434E	10.73 ± 0.28	Hamanasuno	Hurley
3850 B.C. ± 300	MASCA PT 434B	12.9 ± 0.20	Hamanasuno	Hurley
2650 B.C.	Obsidian 2		Bibi	Kondo and Katsui 1965
2650 B.C.	Obsidian 3		Shoppu	
		Middle Jōmon		
2600 B.C. ± 450	MASCA 415B	11.11 ± 0.47	Saibezawa	Oba 1958
2200 B.C.	Obsidian 4		Wakoto	Kondo and Katsui 1965
		**Late Jōmon*		
8900 B.C. ± 560	MASCA PT 416	11.67 ± 0.21	Hiyoshi	Oba and Kodama 1953
		**Final Jōmon*		
1073 B.C. ± 270	MASCA PT 417	12.52 ± 0.25	Kawakami	Yoshizaki 1965
450 A.D.	Obsidian		Wakkaoi	Kondo and Katsui 1965

* Not shown in Figure 8.

sands of years earlier than the reported dates for Incipient Jōmon. PT 415A seems to be somewhat older than anticipated, which may be due to a slightly lower than usual alpha count. However, as in the case with PT 415B from the same site, Saibezawa, this date can be considered as acceptable from this deeply (450 cm) stratified (25 levels) multicomponent (Early through Middle Jōmon) site (Kodama, Oba, and Takeuchi 1958).

The date for the Hiyoshi sample, PT 416, of 8900 B.C. is an enigma. There is no good reason that it should be so early, unless it is a case of contamination by a residual geologic signal. However, there is a long history of excavations at this site beginning with a report by John Milne, E. S. Morse, and Thomas Blacksone to the Asia Association (Azia Kyokai) in 1879. Others who have worked at Hiyoshi include Sadakichi Kida, Sugao Yamanouchi, and finally Toshio Oba (1971).

The dated sample PT 414B from Sumiyoshi appears to fall mid-range in the C-14 sequence and to be acceptable. The Kawakami date of 1073 B.C. (PT 417) appears to date a Final Jōmon component at this site, althogh the final report on the site has not yet appeared. However, Masakazu Yoshizaki (1965:47) made a brief



Distribution of: Thermoluminescence Dates (434 A–E)
Radiocarbon Dates (C14)
Fagopyrum esculentum Moench. (Soba or buckwheat)

Fig. 4

reference to it. The pottery recovered is reported as Middle Jōmon Ento Joso (Upper Ento A), so our sample may represent the yet unreported Final Jōmon component which is in the Hakodate Museum.

The Hamanasuno sample from House 27 (PT 434A) is critically important because of factors to be reported in this paper and those reported by Crawford, Hurley, and Yoshizaki (this volume). Neither Ralph nor Han has indicated to Hurley any problem in the alpha counts. Working with the assumption that the date is correct, let us examine first the range reported and second the context. The plus and minus factor of 1000 years means the sample could date at 6900 B.C., 5900 B.C., or 4900 B.C. Our C-14 range (Table 1) yields a range of more than 5390 B.C. to 2190 B.C. and our only obsidian hydration dates are 2650 B.C. (Table 2). Thus, our low-range date of 4900 is acceptable and the central date of 5900 exceeds the C-14 range by 510 years, which may be considered as reasonable. The high-range date of 6900 B.C. exceeds the dates reported for Earliest Jōmon and would be unacceptable to most archaeologists familiar with Early Jōmon in Hokkaido. If the central to low range date for PT 434A is correct, and we believe it is, then it is dating an Early Jōmon semisubterranean pit house.

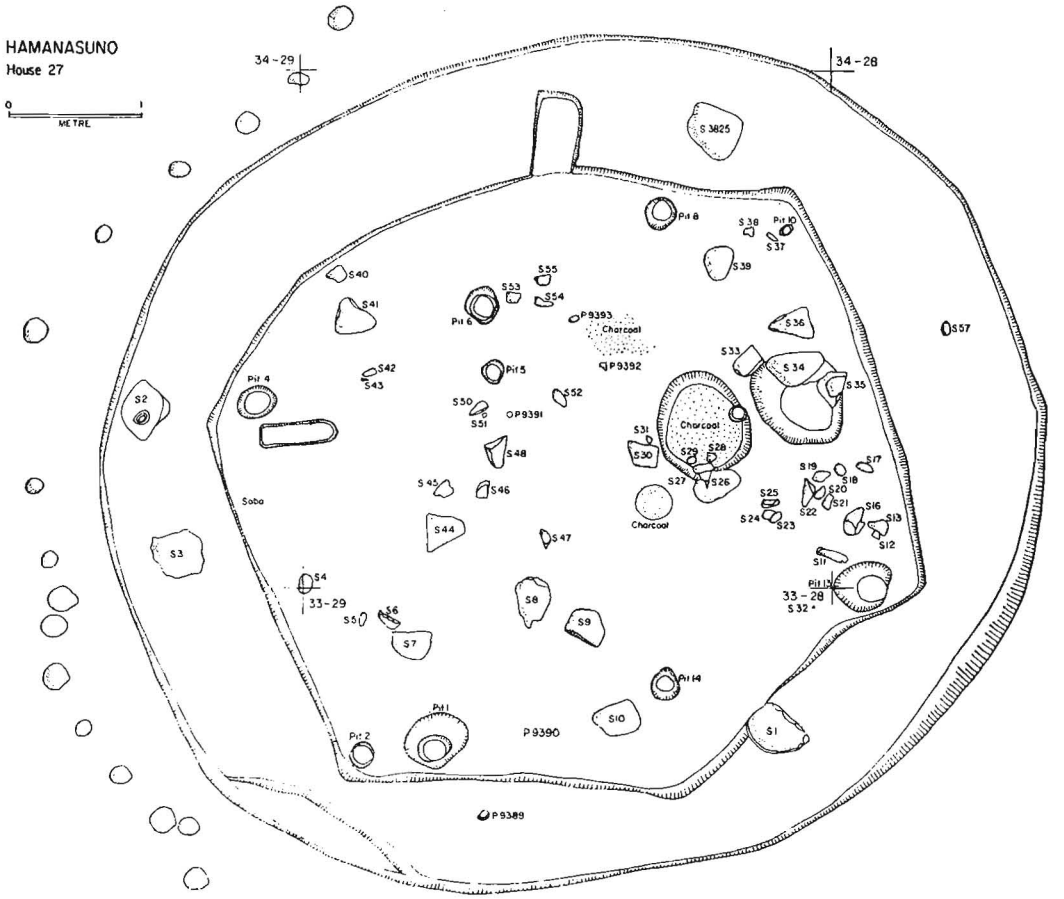
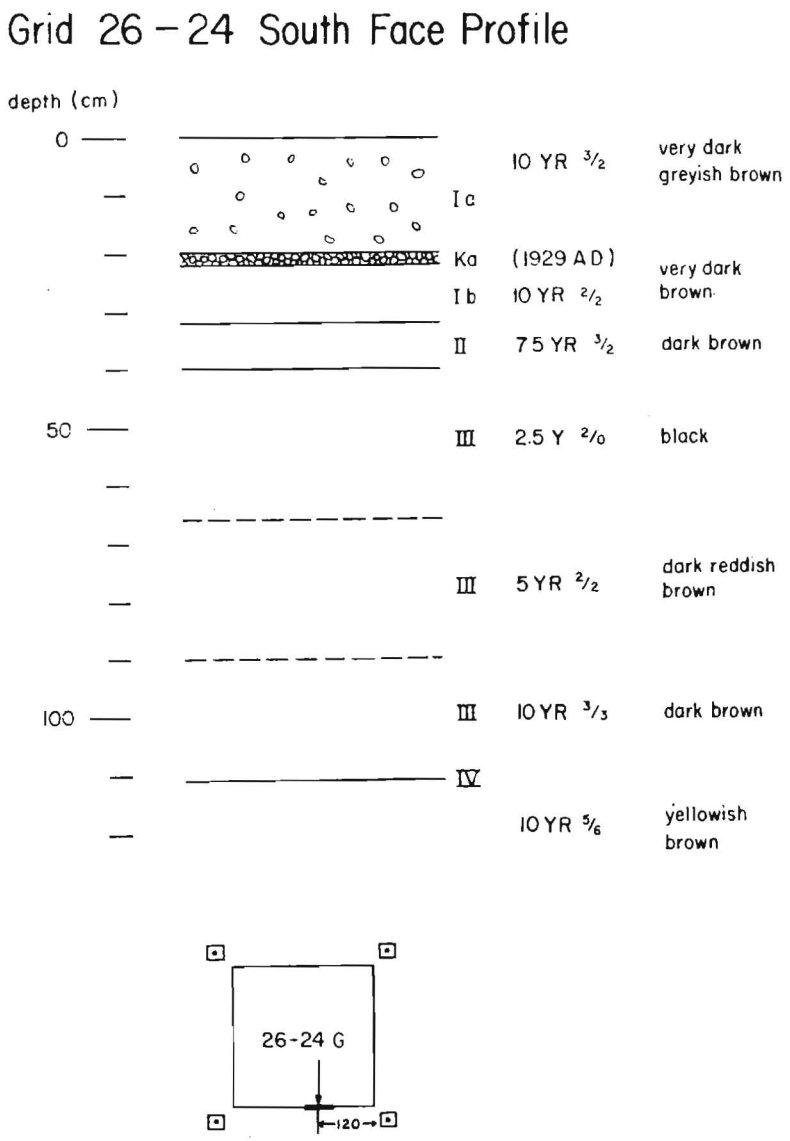


Fig. 5

Sample PT 434A has our catalogue number 7276. It is recorded as being identified as Pottery no. 2 located above the floor, in level X2, in pit house 27 (figs. 4 and 5), and it is tentatively identified as Ento-Kaso D. The normal nonhouse profile illustrated in Figure 6 does not contain a level X2, as this designation was usually reserved for archaeological horizons associated with houses. The profile drawn along our north-south grid line 33 illustrates the extent of level X2 and its relationship to the house (Fig. 7). Stratigraphically, level X2 is well below any zone of historic cultivation such as level 1a of Figures 6 and 7 and below any disturbed zones as illustrated in Figure 7.



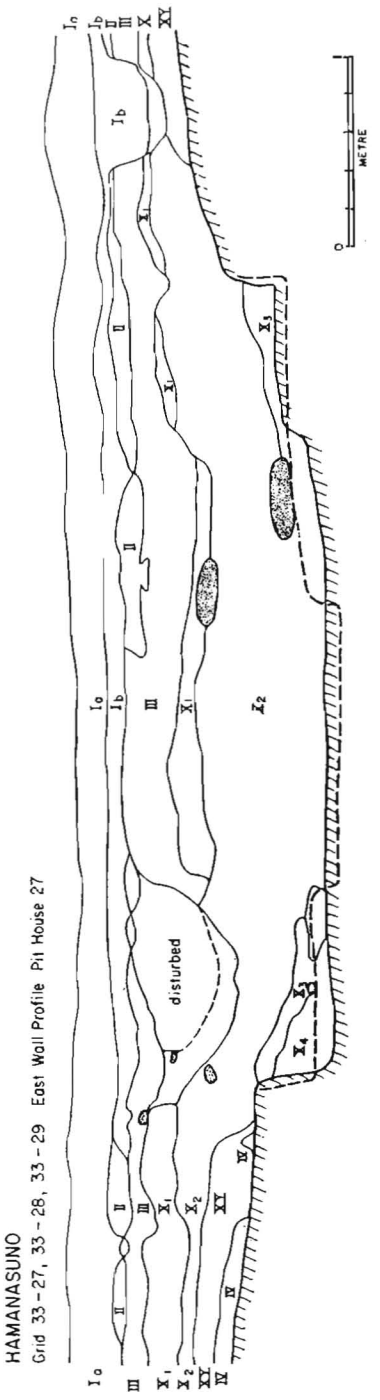

HAMANASUNO
Grid 33 - 27, 33 - 28, 33 - 29 East Wall Profile Pit House 27
disturbed
METRE
0

Fig. 7

Before examining the date of PT 434A further, we should consider the additional TL dates. TL sample PT 434C was removed from grid G27–23 in subsquare K, Level III, which was horizontally within pit house 33 (Fig. 4), but vertically above the house in a midden level that had accumulated after the house basin had been filled and abandoned. Level III was a dark brown-black colored horizon with yellow pumice speckle throughout. The TL date for the pottery provisionally identified as Ento-Kaso D is 4200 B.C. ± 600 (Table 2 and Fig. 8). The third TL sample, PT 434E, also was recovered from within pit house 33 in grid G27–23

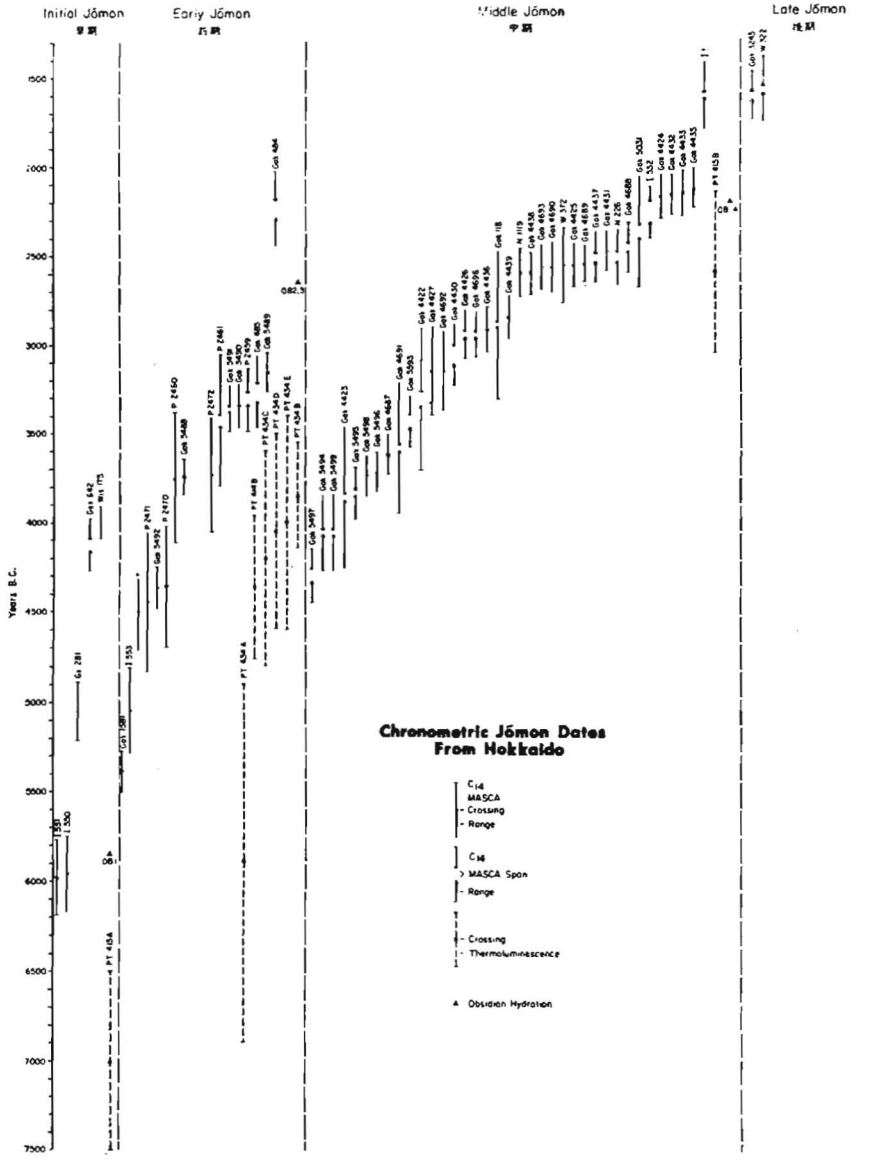


Fig. 8

subsquare D in level X1, a dark brown to blackish brown layer with some specks of pumice. This level is also above the house floor, but it represents a horizon containing debris purposefully used to fill the house basin very shortly after abandonment. The PT 434E pottery is also provisionally identified as Ento-Kaso D and is dated at 4000 B.C. ± 600 (Table 2 and Fig. 8).

The final house TL sample, PT 434D, was contained in pit house 32 and taken from pit number 6, which originated in the house floor (Fig. 4). The pottery identified with PT 434D is tentatively identified as Ento-Kaso D and dated at 4050 B.C. ± 500 (Table 2 and Fig. 8). Finally, sample PT 434B was recovered from grid G32–24 in subsquare J (Fig. 4) in a horizon designated as a localized X2 even though there was no evidence in this area of a possible house structure. The profile from this grid shows this disturbed X2 horizon above Level III and below Level II (Ko-d); the TL date is 3850 B.C. ± 300 (Table 2 and Fig. 8).

From an independent volcanic viewpoint, it is thought that the Hamanasuno area felt the effects of several Quaternary eruptions from the volcano Komaga-Take (Fig. 9); the most recent eruptions of Komaga-Take have been reported historically while earlier ones have been C-14 dated (Wataru Matsushita 1974: 14–16). The most recent eruption of Komaga-Take, which occurred in A.D. 1929, is designated as eruption Ko-a or our Ka level in Figure 6. Our level II is an earlier eruption equivalent to Ko-d_2, which is dated at A.D. 1640 (Tatsuo Sasaki et al. 1970, 1971). These two levels seal in the prehistoric occupation. Other dated Komaga-Take eruptions are as follows:

		B.P. CORRECTED	
Ko-e	1700±130 B.P. Gak 2831;	A.D. 250	1751 MASCA A.D. 260±140
Ko-f	2750±110 B.P. Gak 2836;	B.C. 800	B.C. 2832 MASCA 990–940 B.C.±120
Ko-g	4780±110 B.P. Gak 3338;	B.C. 2830	B.C. 4923 MASCA 3620 B.C.±120
Ko-h	5750±110 B.P. Gak 3334;	B.C. 3800	B.C. 5922 MASCA 4590 B.C.±120

It was felt during our field excavations in 1974 that Level IV (subdivided into a, b, and c) collectively represented Ko-h, or to date from MASCA, 4590 B.C. Our level VI, which is undated, was designated as Ko-i; thus the occupation, undisturbed in our area A excavations, was sealed in by two volcanic layers dating A.D. 1929 and A.D. 1640 and was above two volcanic layers, of which one is dated (Ko-h) as 4590 B.C.

From the dual perspective of our TL dates and the C-14 dates on Komaga-Take, we can see that the low-range date for PT 434A of 4900 B.C. is close to the upper C-14 date range for Level IV (Ko-h) of 4590 ± 120 or 4710 B.C. This suggests that all of our TL dates conform to the chronological confines of the Komaga-Take dates. Additional checks on our TL dates were made by alpha counts on a series of soil samples removed from one profile.

These soil samples were removed from the east wall of G33–24 at a point 50 cm from the north wall for the original purpose of pollen analyses. Once this analysis had been completed (see Crawford, Hurley, and Yoshizaki, this volume) the samples were submitted to MASCA. Table 3 shows the sample number, its horizon or layer, depth from the surface, pH, Komaga-Take date, and the Alpha C/hr. As our TL

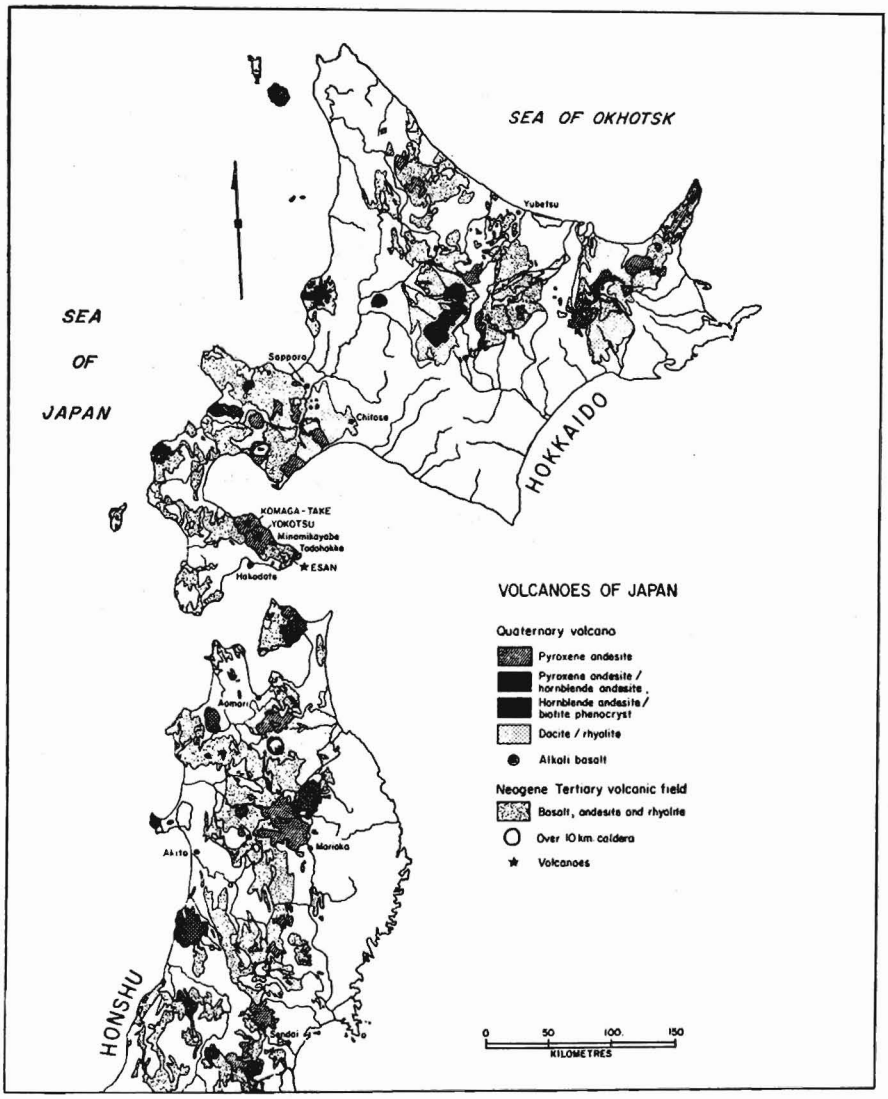


Fig. 9

pottery dates were on fragments recovered from levels below Level II and above Level IV, we can see from Table 3 that our sherds have yielded alpha counts above the alpha rate of the soil. Furthermore, for all horizons, 80 percent or more have alpha rates which are lower than those for the sherds. Therefore they are not contributors to the TL dates and need not be considered as radioactive contaminators.

As a fourth internal check on our chronometric perspective (after having considered the TL dates, the C-14 dates for the Komaga-Take horizons, and the Alpha soil counts), we have the C-14 samples for Area A. Six samples were submitted to MASCA; the earliest C-14 date is from a sample (P2471) collected between grids G28–23 and 29–23 in level X1 adjacent to pit house 33 (Fig. 4). It has produced a

TABLE 3. HAMANASUNO SOIL (PT 434) FROM EAST WALL OF G 33–24

SAMPLE NO.	HORIZON/LAYER	DEPTH FROM SURFACE (CM)	PH	KOMAGA-TAKE DATE	ALPHA C/HR.
1	1a	5	6.0		10.41 ± 0.24
2	1a	10	6.0	Ko-a A.D. 1929	11.21 ± 0.46
3	1b	20			10.65 ± 0.20
4	1b	25			12.52 ± 0.30
5	II	30	6.0	Ko-d A.D. 1640	19.90 ± 0.29
6	III	40	6.0		6.39 ± 0.18
7	III	50	6.0		2.49 ± 0.15
8	IVa	62	6.5		2.41 ± 0.13
9	IVb	72	6.5	*	
10	IVc	79	7.0	Ko-h MASCA 4590 B.C.	4.34 ± 0.40
11	Va	88	7.0		5.35 ± 0.17
12	Va	96	7.0		5.05 ± 0.23
13	Vb	110	7.0		7.53 ± 0.21
14	Vb	120	7.0		4.90 ± 0.22
15	VI	125	7.0		11.99 ± 0.26

* No soil remaining after pollen analyses.

date of 4550 B.C. ± 390, which is in general agreement with the two TL dates (P434 C and E) from House 33 of 4200 B.C. ± 600 and 4000 B.C. ± 600 (Tables 1 and 2).

The next two C-14 dates are from House 30a, with the first (P2470) from level X3, the house floor, and the second from grid G25–25 subsquare O, level X3, house floor (P2460). The first date is 4360 B.C. ± 340 and the second is 3750 B.C. ± 360. When their respective ranges are considered they also show overlaps and agreement (Table 2).

Sample P2472 from House 27, floor, was counted three times with a result of 3740 B.C. ± 320, a date which is within the acceptable range of the C-14 dates and all but one of the TL (PT 434A) dates (Tables 1 and 2). That TL date of 5900 ± 1000 is from a vessel in the same house but from a level above the floor. We find the C-14 date acceptable and will argue later that the lower range of 4900 for PT 434A is also acceptable.

House 32 had a charcoal sample collected from internal house pits numbers 6, 7, and 8, and the combined sample (P2461) has yielded a date of 3470–3400 B.C. ± 340. A TL date taken from pit 6 (PT 434D) produced the date of 4050 ± 550, which overlaps and agrees with the C-14 date. The final C-14 date (P2459) is from pit house 31, and it yielded a date of 3350–3270 B.C. ± 140.

If we examine the reported C-14 range for Hamanasuno we can produce the following:

Maximum C-14 range

P2461 3470–3400 B.C. ± 340 = 3060 B.C.
P2471 4550 B.C. ± 390 = 4940 B.C. = 1880 C-14 years

Medium less ±

4550 B.C. — 3400 B.C. = 1150 C-14 years

Minimum

P2461 3470–3400 B.C. ± 340 = 3810
P2471 4550 B.C. ± 390 = 4160 = 350 C-14 years

Our ranges for the TL dates are as follows:

Maximum TL range

PT434A 5900 B.C. ± 1000 = 6900
PT434E 4000 B.C. ± 600 = 3400 = 3500 TL years

Medium less ±

5900–4000 = 1900 TL years

Minimum

PT434A 5900 B.C. ± 1000 = 4900
PT434E 4000 B.C. ± 600 = 4600 = 300 TL years

Before considering the Hamanasuno dates any further, let us examine the range of dates for two nearby sites: Nishimata and Morikoshi (Fig. 3). Morikoshi has two well dated components. The Early Jōmon range is as follows (Table 1 and Fig. 8):

Morikoshi Early Jōmon C-14 range

Maximum

Gak 5489 3160 B.C. ± 150 = 3010
Gak 5492 4370 B.C. ± 115 = 4485 = 1475 C-14 years

Medium less ±

4370–3160 = 1210 C-14 years

Minimum

Gak 5489 3160 B.C. ± 150 = 3310
Gak 5492 4370 B.C. ± 115 = 4255 = 945 C-14 years

Middle Jōmon C-14 range

Maximum

Gak 5496 3720 B.C. ± 110 = 3610
Gak 5497 4330–4270 B.C. ± 120 = 4450 = 840 C-14 years

Medium less ±

4270–3720 = 550 C-14 years

Minimum

Gak 5496 3720 B.C. ± 110 = 3830
Gak 5497 4330–4270 B.C. ± 120 = 4150 = 320 C-14 years

Nishimata Middle Jōmon C-14 range

Maximum

Gak 4688 2480–2440 B.C. ± 120 = 2320
Gak 4691 3600–3570 B.C. ± 350 = 3950 = 1630 C-14 years

Medium less ±

3570–2480 = 1090 C-14 years

Minimum

Gak 4688 2480–2440 B.C. ± 120 = 2600
Gak 4691 3600–3570 B.C. ± 350 = 3220 = 620 C-14 years

Thus we can illustrate the Early Jōmon and Middle Jōmon C-14 ranges as:

	Early			Middle	
	Hamanasuno		Morikoshi	Morikoshi	Nishimata
	C-14	TL	C-14		
Maximum	1880	3500	1475	840	1630
Medium	1150	1900	1210	550	1090
Minimum	350	300	945	320	620

If we consider minimum ranges we are left with very little temporal room to discuss cultural developments, although there are numerous archaeologists who would view a 300-year site occupation as excessive. However, we all must realize that a site can be occupied for a short duration. For example, the Armstrong Oneota site in Wisconsin had five C-14 dates with a medium spread from A.D. 1010 to A.D. 1190 or 180 years, which is acceptable for this single-component site (Hurley 1978*a*). A similar restricted range is reported for a Paleo-Indian site in Canada, which had thirteen radiocarbon determinations limited to an average of 10,600 ± 47 B.P. (MacDonald 1968).

However, short-term occupations are now being recognized as a biproduct, in some cases, of dependence on one or two C-14 dates. The senior author has reported on two Late Woodland sites from Wisconsin, one having ten C-14 dates spanning approximately 700 years and the second with twenty C-14 dates covering a 600-year period (Hurley 1975). When we try to correlate chronometric years, be they C-14, dendrochronological, obsidian hydration, or thermoluminescent, with archaeologically perceived cultural, stage, or ceramic years, then we are faced with comparing phenomena which may not as yet be fully understood.

During the Middle Jōmon stage at Nishimata we can see a 1210-year spread between the maximum and minimum range. Yamada Goro in the Nishimata report (Wataru Matsushita 1974) discussed Nodappu II pottery and viewed it as being a single type which could not be further subdivided. He suggested that Gak 4691 and 4688 had too great a range for one pottery type (our corrected maximum 1630 years) and thus were unacceptable, while ignoring either the medium of 1090 or the minimum of 420 C-14 years. He was left with no alternative than to reject four of the very early and very late dates and to accept those in the mid-range. He closed by saying that "a C-14 date range of fairly large dimension for one pottery type is a problem that should be considered in the future" (1974: 92).

We do not believe that one can state with any certainty the average length or duration of all pottery types. Some will have greater longevity than others and cover a larger geographic area. To reject four dates which are significant without explaining their significance or what they are dating is scientifically unacceptable. There is much that remains unknown concerning pottery types throughout the world along with the degree and longevity of site occupations or cultural periods. The latter is clearly illustrated in Figure 8 with the more than 1000-year overlap of Early and Middle Jōmon.

Hamanasuno, Morikoshi, and Nishimata have the greatest number of dates for Jōmon sites in southwestern Hokkaido. They suggest that additional series of site dates of C-14, TL, and obsidian hydration must be added to those illustrated in Figure 8. It is too early even to attempt a statistical analysis of what dates to accept or reject, as has recently been suggested (Long and Rippeteau 1974). Accordingly we will allow ourselves maximum room for the final cultural interpretations in our report on Hamanasuno and suggest that Area A was occupied from 4940 B.C. to 3100 B.C., with a central temporal point being around 4100 B.C. At this time we cannot say if there was continuous occupation or successive occupations of unknown durations, as the Early Jōmon settlement patterns are just beginning to emerge.

The implications of our dates for domesticates in Early Jōmon are elaborated upon by Crawford, Hurley, and Yoshizaki. However, there is another subsistence factor which needs to be introduced now. A total of 259 fragmentary calcined bones were recovered from beneath vessels in square and house contexts. Of these, identification to class was possible for 91 specimens, with 72 recognized as mammalian, three as avian, and 13 as bony fish (Savage 1975). Of the mammalian findings Howard Savage (1975) has identified eight seal specimens, that is, three northern fur seal *(Callorhinus ursinus)*, an earless seal (subfamily Phocinae), a large seal or sea lion (family Otariidae), and another seal to make up the Pinniped group.

Northern fur seals were noted by Scheffer (1958) as being widely dispersed during winter and spring over the North Pacific Ocean, including the Sea of Japan and the Sea of Okhotsk, as far south as the waters of Honshu in latitude 30° North. Seals of the subfamily Phocinae in the vicinity of Hokkaido are the Harbour Seal *(Phoca vitulina)*, the Ringed Seal *(Pusa hispida)*, and the Ribbon Seal *(Histriophoca fasciata)* (Wilke 1954). The large otariid seal is in the size range of the Northern Fur Seal and Northern Sea Lion *(Eumetropias jubata)*, both of which occur in the vicinity of Hokkaido (Scheffer 1958 and Okada 1938). Another sea mammal group represented is the porpoises (family Delphinidae).

Land mammals represented are a hoofed mammal (deer of the order Artiodactyla) and a snowshoe hare, possibly *Lepus timidus* (Imaizumi 1970). One avian bone was identified as being from a cormorant of the genus *Phalacrocorax*, within the size range of the Pelagic Cormorant *(P. pelagicus)*. The other avian bones could not be identified more precisely. Finally, thirteen bony fish elements were identified.

To summarize this data:

1. There are as yet no other known reports of Early Jōmon peoples in Hokkaido exploiting the maritime resources of sea mammals such as seals and porpoises.
2. The present-day distribution of these mammals is believed to be far north and east of the Hamanasuno Site.

3. Land mammals (hare and deer) were exploited with both groups offering information about seasonal exploitations.
4. Fish and bird remains suggest that both riverine and nonterrestrial resources were being utilized.

As each recovered bone specimen has a horizontal, vertical, and archaeological context (most were recovered from Houses 31, 32, and 33), we can closely correlate this data with the artifactual data already in control.

The foregoing preliminary data now support our aim of ascertaining the nature of the economic and subsistence base of the Early Jōmon peoples and will temporarily place Hamanasuno as one of the important sites in Hokkaido and Japan. Of greater importance are three factors: (a) this subsistence data must be placed in good archaeological context to round out the Early Jōmon lifeway and allow for more elaborate interpretations; (b) all of the data presently have tight C-14 and TL dates; and (c) it is suggested that these new aspects of Hamanasuno are not unique but rather that our research methodology was new, and with the acceptance of these data Japanese archaeologists will be able to find many more sites with a wide range of domesticated plants. This must ultimately extend into central Asia and specifically North China, as others such as Solheim (1970) have proposed a "plant world" of domestication separate from that to the south.

ADDENDUM

The following dates from the Hakodate Kuko (Airport) site have recently been published by Chio (1977) and represent dates from the earliest phases of Early Jōmon.

			CORRECTED		MASCA
LAB	B.P.	B.C.	B.P.	B.C.	CORRECTION
N2498	4960 ± 110	3010 ± 110	5100	3159	3750 B.C. ± 120
N2499	5430 ± 140	3480 ± 110	5593	3643	4360 B.C. ± 120
N2500	5020 ± 110	3070 ± 110	5170	3220	3780 B.C. ± 120
N2501	4720 ± 90	2770 ± 90	4861	2911	3560 B.C. ± 100
N2502	4920 ± 75	2970 ± 75	5068	3118	3730 B.C. ± 85
N2503	5100 ± 105	3150 ± 105	5253	3303	3900 B.C. ± 115
N2504	4900 ± 95	2950 ± 95	5047	3097	3710 B.C. ± 105
N2505	4710 ± 90	2760 ± 90	4851	2901	3540 B.C. ± 100
N2506	4880 ± 140	2930 ± 140	5026	3076	3700 B.C. ± 150
N2507	8190 ± 130	6240 ± 130	8435	6485	
N2508	8030 ± 105	6080 ± 105	8271	6321	Beyond the
N2509	8250 ± 115	6300 ± 115	8497	6547	present range
N2510	7850 ± 90	5900 ± 90	8085	6135	of MASCA
N2511	7510 ± 245	5560 ± 90	7735	5785	
N2512	10300 ± 160	8350 ± 160	10609	8659	
N2513	7910 ± 80	5960 ± 90	8147	6197	
N2514	7690 ± 125	5740 ± 125	7921	5971	
N2515	7520 ± 150	5570 ± 150	7746	5796	
N2516	7750 ± 120	5800 ± 120	7982	6032	
N2517	7280 ± 170	5330 ± 170	7498	5548	

Kazuo Sato (1976*b*) has reported two other new dates, which are from the Uenae shell mound and the Yanagidate shell mound, respectively.

LAB	B.P.	B.C.	CORRECTED B.P.	MASCA CORRECTION
Gak 4372	5600 ± 100	3650 ± 100	3818	4480 B.C. ± 110
Gak 5735	5350 ± 120	3400 ± 120	3502	4190 B.C. ± 130

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